

Kinematics Equations

Constant Velocity

$$v = \frac{\Delta d}{\Delta t}$$

Constant Acceleration

$$a = \frac{\Delta v}{\Delta t}$$

(recall: $\Delta v = v_2 - v_1$)

$$v_{\text{ave}} = \frac{\Delta d}{\Delta t}$$

(recall: $v_{\text{ave}} = \frac{v_1 + v_2}{2}$)

ONLY when acc is constant

Maybe Useful Equations:

$$\textcircled{1} \quad \Delta d = v_1 \Delta t + \frac{1}{2} a (\Delta t)^2$$

$$\textcircled{2} \quad \Delta d = v_2 \Delta t - \frac{1}{2} a (\Delta t)^2$$

$$\textcircled{3} \quad v_2^2 = v_1^2 + 2a\Delta d$$

always given

One More Example:

An airplane must reach a velocity of 71 m/s for takeoff. If the runway is 1.0 km long, what must the constant acceleration be?

$$V_1 = 0 \text{ m/s}$$

$$V_2 = 71 \text{ m/s}$$

$$\Delta d = 1.0 \text{ km}$$

$$a = ??$$

$$\text{units: } \frac{\cancel{\text{m}^2/\text{s}^2}}{\cancel{\text{m}}} \\ \text{m/s}^2$$

$$V_2^2 = V_1^2 + 2ad$$

$$\frac{V_2^2 - V_1^2}{2ad} = \frac{2ad}{2ad}$$

$$a = \frac{V_2^2 - V_1^2}{2ad}$$

$$a = \frac{(71 \text{ m/s})^2 - 0^2}{2(1.0 \times 10^3 \text{ m})}$$

$$a = 2.5 \text{ m/s}^2$$

How could you find your reaction time by using a ruler?

$$\begin{array}{l} \text{start: } d_1 \\ \text{finish: } d_2 \end{array} \left. \vphantom{\begin{array}{l} \text{start: } d_1 \\ \text{finish: } d_2 \end{array}} \right\} \Delta d$$

$$V_i = 0$$

$$a = 9.81 \text{ m/s}^2$$

$$\Delta t = ?$$

$$\Delta d = V_i \Delta t + \frac{1}{2} a (\Delta t)^2$$

$$\Delta d = \frac{1}{2} a (\Delta t)^2$$

$$\frac{2\Delta d}{a} = \frac{a(\Delta t)^2}{a}$$

$$(\Delta t)^2 = \frac{2\Delta d}{a}$$

$$\Delta t = \sqrt{\frac{2\Delta d}{a}}$$

TODO

① PP/89

② Calculator Pad (All)